

EXPRESS MAIL NO. EV530944081US

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 (72) Inventor VASCO MEZZEDIMI



## (54) PRESSURE VESSELS

(71) We, NUOVO PIGNONE S.p.A., an Italian Company, of Via Matteucci, 2, Florence, Italy, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to pressure vessels intended to withstand high internal pressures. An example of such a vessel is the casing of a centrifugal compressor working at high gas pressures.

According to the present invention, there is provided a sealable pressure vessel which comprises:

a container having a region defining a mouth and provided with a first circumferential groove in the internal face of the region and with a circumferential recess at the boundary between the internal face of the region and the end face of the region remote from the interior of the container;

a member corresponding in shape to the mouth and locatable within the mouth, the member having a circumferential second groove which, when the member is correctly located in the mouth, is opposite the first circumferential groove;

a plurality of elements movable between a first position in which they are accommodated fully within the first groove and a second position in which they are accommodated partially within the first groove and partially within the second groove, whereby with the elements in the first position the member can be moved into and out of the mouth, and with the elements in the second position the member is secured in the mouth;

movable means accessible from outside the container for moving the elements between the first and second positions; and

sealing means for effecting a seal between the container and the member when the latter is secured in the mouth, the sealing means including a ring seal locat-

able within the circumferential recess and a pressure ring for forcing the ring seal into the circumferential recess. 50

The pressure vessel of the present invention can be easily and quickly assembled and dismantled.

Preferably the mouth-defining region of the container is annular, in which case the member is cylindrical, the first and second grooves are annular, and the elements are segments of an annular stop ring. 55

The various annular segments can be wholly withdrawn into the first groove by withdrawing the movable means, which can be a plurality of lifting pins, whereby the member can be quickly released. 60

In addition to the aforementioned sealing means, there is preferably provided on that side of the stop ring nearer the interior of the container a conventional O-ring housed in a suitable recess in the outwardly directed face of the member. 65 70

In the first-mentioned sealing means, the ring seal is preferably a metallic ring having a trapezoidal cross-section, which is intended to be squashed between the container and the member by a pressure to be screwed on the member and fixed to the end face of the region of the container, for example by means of screws. Preferably each element is provided with its respective movable means, and each movable means extends through a respective aperture in the container. The sealing of the holes through which the movable means for moving the elements extend can be achieved by screw plugs and suitable packings. 75 80 85

For a better understanding of the present invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawing which shows a cross-section through part of a pressure vessel according to the present invention. 90

In the drawing there is shown a cylindrical body 11 of a centrifugal compressor and a circular plate 12 located within one end of the body 11. In the circumferential sur- 95

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face of the plate 12 there is provided a circumferential groove 13. A similar but deeper groove 14 is provided in the inwardly facing surface of the body 11 at a point  
5 opposite the groove 13. Located in the grooves 13 and 14 is a plurality of annular segments 15 of a stop ring. The segments 15 are radially movable within the grooves 13 and 14 and can be accommodated either  
10 completely within the groove 14, or partially within the groove 14 and partially within the groove 13 (as illustrated). In the position illustrated in the drawing the sides of the segments 15 abut the sides of the grooves 13 and 14 so as to effect the clamping of  
15 the plate 12 in the body 11. Each segment 15 is connected to a respective movable member in the form of a pin 16. The pins 16 are located in holes 17 and extend outside the body 11. The pins 16 enable the  
20 segments to be moved radially inwards and outwards, from outside the body 11. In the position shown in the drawing the segments 15 completely occupy the groove 13. The pins 16 and segments 15 allow a rapid  
25 release of the plate 12, which allows a quick assembly and dismantling of the plate 12.

In order to seal the pressure vessel, in the cylindrical surface of the plate 12, nearer  
30 the interior of the container 11 than the groove 13 there is a circumferential recess 18 wherein an O-ring 19 is housed. However, in order to ensure effective sealing when working with high pressures, a more  
35 effective, further sealing system is provided. This latter sealing system comprises an annular ring 20 of trapezoidal cross-section and formed of a malleable metal. The ring 20 is introduced into an inwardly-facing  
40 recess 21 in the body 11 and is squashed up against the inclined inner end of the recess 21 by a pressure ring 22 screwed onto a screwthreaded outer region 23 of the plate  
45 12. The inclined inner end of the recess 21 and the inclined inner end of the pressure ring 22 ensure that the annular ring 20 is squashed towards the gap between the body 11 and plate 12 so as to ensure an  
50 effective seal. The pressure ring 22 is secured to the end face 24 of the body 11 by screws. The annular ring 20 can, if desired, be made of a material other than metal.

The sealing of the holes 17 is ensured by  
55 screw plugs 25 and suitable packings 26.

#### WHAT WE CLAIM IS:—

1. A sealable pressure vessel, which comprises:  
60 a container having a region defining a mouth and provided with a first circumferential groove in the internal face of the region and with a circumferential re-

cess at the boundary between the internal face of the region and the end face of the region remote from the interior of the container;

a member corresponding in shape to the mouth and locatable within the mouth, the member having a circumferential  
70 second groove which, when the member is correctly located in the mouth, is opposite the first circumferential groove;

a plurality of elements movable between a first position in which they are accommodated fully within the first groove and a second position in which they are  
75 accommodated partially within the first groove and partially within the second groove, whereby with the elements in the first position the member can be moved into and out of the mouth, and with the  
80 elements in the second position the member is secured in the mouth;

movable means accessible from outside the container for moving the elements between the first and second positions; and

sealing means for effecting a seal between the container and the member when the latter is secured in the mouth, the  
90 sealing means including a ring seal locatable within the circumferential recess and a pressure ring for forcing the ring seal into the circumferential recess.

2. A pressure vessel according to Claim 1, wherein the ring seal is trapezoidal in cross-section and the parallel faces of the trapezoid are cylindrical.

3. A pressure vessel according to Claim 1 or 2, wherein the pressure ring is provided with an internal screwthread capable of engagement with an external screwthread on the member.

4. A pressure vessel according to Claim 3, wherein the pressure ring is provided with apertures, and wherein the vessel includes  
105 fixing means capable of passing through the apertures and of engagement in said end face of the region.

5. A pressure vessel as claimed in any preceding claim, wherein the member is provided with a circumferential recess between the second groove and that face of the member intended to face the interior  
115 of the container, and wherein an O-ring is located in the circumferential recess of the member, the O-ring functioning as a sealing means when the member is located in the container.

6. A pressure vessel as claimed in any preceding claim, whether the container is cylindrical, the mouth is cylindrical, the member is circular, and the elements are  
120 annular segments.

7. A pressure vessel as claimed in any preceding claim, wherein each element is

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provided with its respective movable means, and each movable means extend through a respective aperture in the container.

5 8. A pressure vessel as claimed in Claim 7, wherein each of the apertures through which a movable means extends is sealed by a hollow screw plug screwed into the container and abutting sealing material.

10 9. A pressure vessel substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawing.

HASELTINE, LAKE & CO.,  
Chartered Patent Agents,  
28, Southampton Buildings,  
Chancery Lane,  
London, WC2A 1AT,

and  
Temple Gate House, Temple Gate,  
Bristol, BS1 6PT,

and  
9 Park Square,  
Leeds, LS1 2LH.  
Agents for the Applicants.

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